Mathematics II

Course Code: MAT 102

Question

MAT 102 FOR COLLEGE 1 AUDITORIUM GROUP (DR. OYELAMI)

QUESTIONS

1. A particle moves along a curve, $x=7t^2$, $y= 6t^2 -4t$, $z=t-5$, where t is time. Find its velocity
2. If A=i+2j-4k, B=2i-3j+k, C=4j-3k, Find AX(BXC)
3. Given $R=4\sin 3ti+4e^{3t}j+7t^3k$, find the integral of R with respect to t
4. If A=7i+2j-k, B=2i+j+4k, C=i+j+k, find (A+C).(B-A)
5. Find a unit vector tangent to the space curve $x = t$, $y= t^2$, $z= t^3$ at the point where t=1.

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MAT 102

$x = 7t^2$, $y = 6t^2 - 4t$ $z = t - 5$

$r = xi + yj + zk$

velocity $= \frac{dr}{dt} = 14ti + (12t - 4)j + k$

$A = i + 2j - 4k$, $B = 2i - 3j + k$, $C = 4j - 3k$

find $A \times (B \times C)$

$$(B \times C) = \begin{vmatrix} i & j & k \\ 2 & -3 & 1 \\ 0 & 4 & -3 \end{vmatrix}$$

$(B \times C) = i((-3 \times -3) - (4 \times 1)) - j((2 \times -3) - (1 \times 0)) + k((2 \times 4) - (-3 \times 0))$

$(B \times C) = i(9 - 4) - j(-6 - 0) + k(8 - 0) = 5i + 6j + 8k$

$$A \times (B \times C) = \begin{vmatrix} i & j & k \\ 1 & 2 & -4 \\ 5 & 6 & 8 \end{vmatrix}$$

$A \times (B \times C) = i((2 \times 8) - (6 \times -4)) - j((1 \times 8) - (5 \times -4)) + k((1 \times 6) - (2 \times 5))$

$A \times (B \times C) = i(16 + 24) - j(8 + 20) + k(6 - 10)$

$= 40i - 28j - 4k$

$R = (4\sin 3t)i + 4e^{3t}j + 7t^3 k$

$\int R\,dt$

$= i\left(-\frac{4}{3}\cos 3t\right) + j\left(\frac{4}{3}e^{3t}\right) + k\left(\frac{7}{4}t^4\right)$

$\therefore \int R\,dt = \left(-\frac{4}{3}\cos 3t\right)i + \left(\frac{4}{3}e^{3t}\right)j + \left(\frac{7}{4}t^4\right)k$

$A = 7i + 2j - k$, $B = 2i + j + 4k$, $C = i + j + k$

find $(A+C)\cdot(B-A)$

$(A+C) = 7i + 2i + 2j + j + 4k - k$

$(A+C) = 9i + 3j + 3k$

$(B-A) = (2i + j + 4k) - (7i + 2j - k)$

$(B-A) = -5i - j + 5k$

$\therefore (A+C)\cdot(B-A) = (9i + 3j + 3k)\cdot(-5i - j + 5k)$

$(A+C)\cdot(B-A) = -45 - 3 + 15$

$(A+C)\cdot(B-A) = -33$

$x = t$, $y = t^2$, $z = t^3$ at point $t = 1$

$r = xi + yj + zk$ $\therefore r = ti + t^2 j + t^3 k$

$\frac{dr}{dt} = i + 2tj + 3t^2 k$

at $t = 1$

Unit vector $= i + 2(1)j + 3(1)^2 k$

$\frac{dr}{dt} = i + 2j + 3k$

$$\left| dr/dt \right| = \sqrt{1^2 + 2^2 + 3^2} = \sqrt{14}$$

$$\therefore \quad T = \frac{dr/dt}{\left| dr/dt \right|} = \frac{i + 2j + 3k}{\sqrt{14}}$$